APPENDIX F

SUMMARY MATERIALS PRESENTED BY WORKSHOP AND BREAKOUT GROUP CHAIRS

SUMMARY MATERIALS

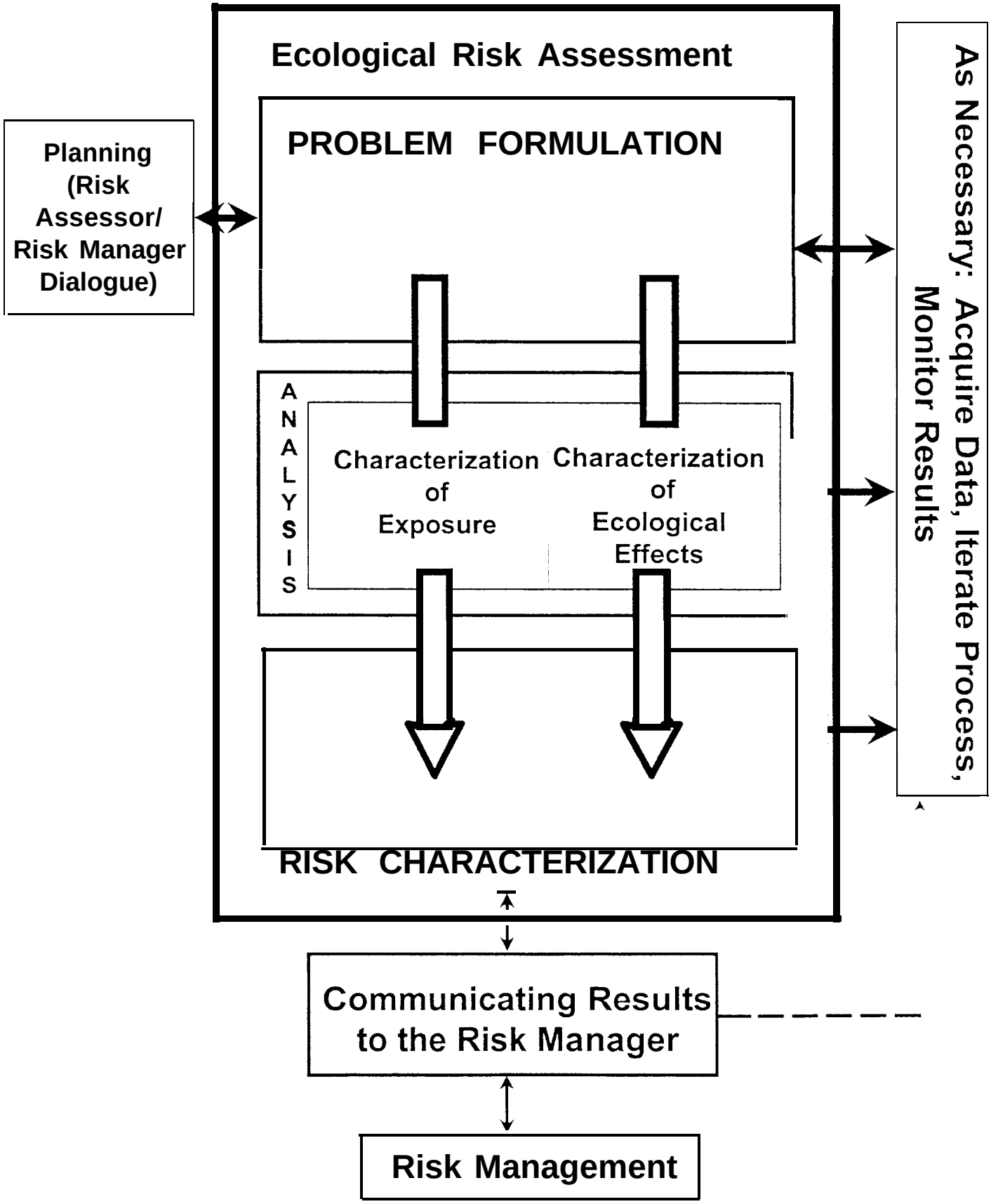
Prepared by:

Dr. Charles Menzie
Menzie-Cura & Associates
(Workshop Chair)

WORKSHOP GOALS

- To complete a qualitative assessment of the risks associated with shrimp viruses following, the general risk assessment process developed by the Aquatic Nuisance Species Task Force
- To evaluate the need for a future more comprehensive risk assessment
- To identify critical risk-relevant research needs along with possible costs and time implications

The Ecological Risk Assessment Process



Ecological Risk Assessment: Problem Formulation

- Define assessment endpoints
  - Assessment endpoints helps to ensure risk assessment addresses important scientific issues while being responsive to management concerns
- Develop the conceptual model
  - Models portray the relationships between stressors, their sources, and the ecological effects they may cause.
- Develop an analysis plan
  - Identify what will be done in an assessment

OUR FOCUS AND APPROACH

We will focus on the scientific aspects related to:

1. likelihood that viruses will become established
2. potential consequences of such establishment

We will rely upon the varied backgrounds and experience represented among the panelists

OUR FOCUS AND APPROACH

Three groups will evaluate the following potential viral pathways:

1. Aquaculture
2. Shrimp processing
3. Other

Our work products will be published in a report that will be used, in part, to inform a JSA Sponsored workshop on risk management. management.

SOME GENERAL GUIDELINES

- Remain focused
- Listen well
- **Contribute your knowledge and** experience
- Be prepared to discuss the issues in an open and thorough manner
- Respect the views of others

OBSERVORS

- You will have an opportunity to comment at the end of each day

- You may also provide oral or written comments/questions to the workshop chair throughout the workshop

Management Goals

Prevent the establishment of new disease-causing viruses in wild populations of shrimp in the Gulf of Mexico and southeastern US. Atlantic coastal waters, while minimizing possible impacts on shrimp importation, processing, and aquaculture operations.

COMMENTS ON THE MANAGEMENT GOAL

40% of us felt it was appropriate (perhaps with clarification or qualification)

Several suggested that it::

- ✓ Should include the aquaculture industry
- ✓ Should consider other pathogenic organisms
- ✓ Should evaluate risk of viruses to other susceptible organisms

Assessment Endpoints

- Survival, growth, and reproduction of wild penaeid shrimp populations in the Gulf of Mexico and southeastern U.S. Atlantic coastal waters.
- Ecological structure and function of coastal and near-shore marine communities as they affect wild penaeid shrimp populations

COMMENTS ON ASSESSMENT ENDPOINTS

- Most agreed with assessment endpoint 1. However, a few of you commented on the need to narrow it somewhat to focus on the specific stressors, i.e., introduced viruses.
- Several of you found the second endpoint to be overly broad and perhaps out of reach of assessment.
- Several suggested that the aquaculture industry be incorporated within an endpoint or as an addition& endpoint.

COMMENTS ON ASSESSMENT ENDPOINTS

A few additional suggestions include:

- ✓ Add an endpoint that relates to possible effects on other species
- ✓ Delete second endpoint and add Maintenance of viable populations and communities of marine organisms, free of virus-induced effects.

COMMENTS ON THE MANAGEMENT GOAL

Other suggestions include:

Expand geographic area of interest to include the Pacific coast

- ✓ Minimize impacts on all industries
- ✓ Specify or confirm that a specific problem exists
- ✓ Prevent recurrent virus epizootic events
- ✓ Emphasize source reduction approaches

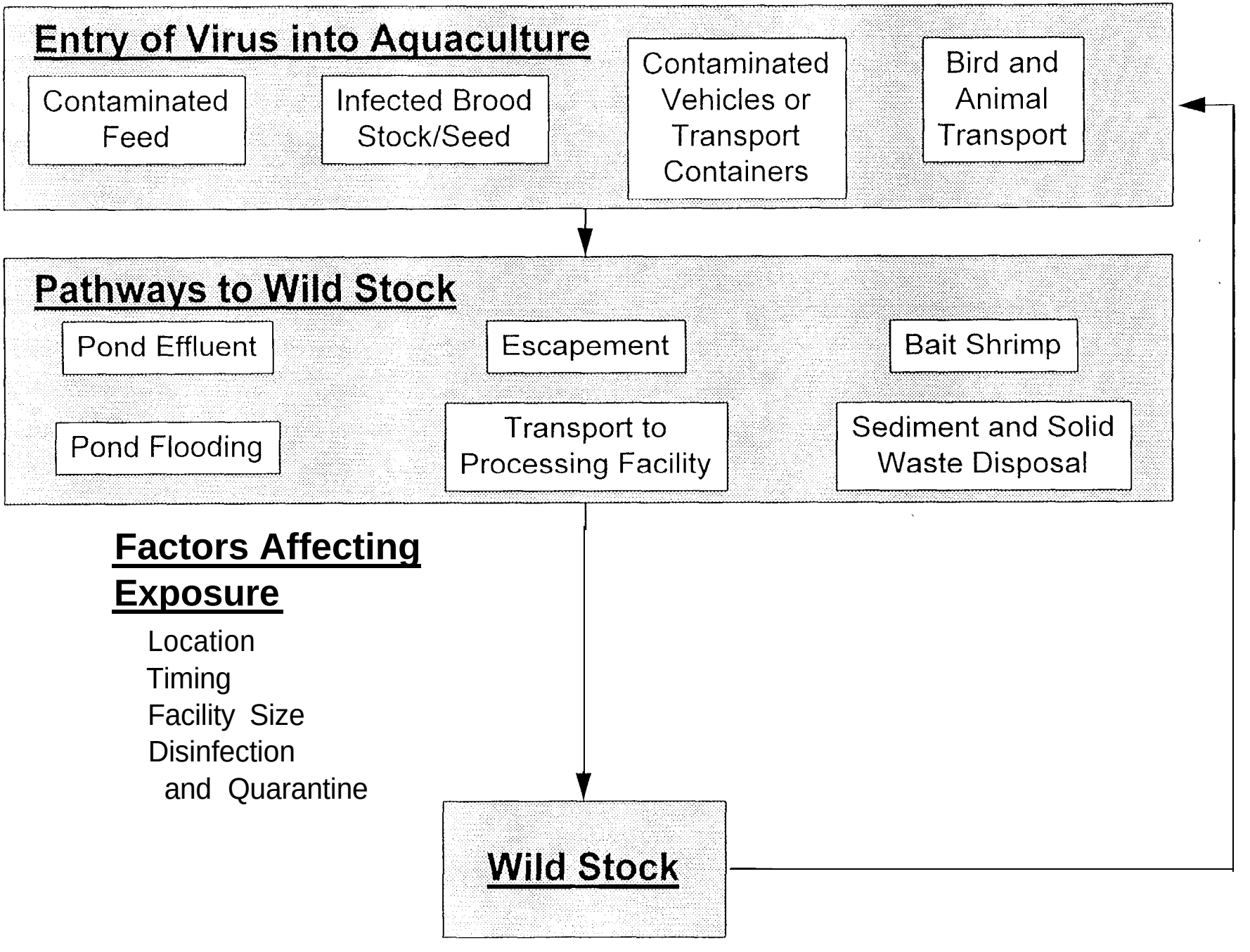
SUMMARY PRESENTATION OF REVIEWERS PREMEETING COMMENTS

AQUACULTURE VIRUS PATHWAYS AND SOURCES

Prepared by:

Dr. Wayne Munns
U.S. EPA

Aquaculture



Premeeting Comments

Virus Sources and Pathways - Aquaculture

Question 9

How does information from local wild shrimp populations support or refute the importance of aquaculture operations as a source for the virus?

Premeeting Comments

Virus Sources and Pathways - Aquaculture

Question 9

Concensus:

- No direct evidence exists

Issues:

- Simple co-occurrence, or occurrence of mortality, not sufficient
- Examples of escaped cultured shrimp exist,

*Data **Gaps:***

- Epidemiology of virus transmission
- Host-specificity of viruses
- Technologies to monitor infection in populations natural and transmission of viruses in discharges (e.g., molecular probes, biomarkers)

Premeeting Comments

Virus Sources and Pathways - Aquaculture

Question 10

It is unusual for domestic animals to infect wild populations. How well does this observation apply to the relationship between shrimp in aquaculture and wild shrimp populations?

Premeeting Comments

Virus Sources and Pathways - Aquaculture

Question 10

Concensus:

- No direct evidence exists in wild U.S. shrimp; may have occurred elsewhere
- Numerous examples for other diseases do exist
- Proposed pathway reasonable

Issues:

- Evidence of reverse transmission may exist
- Evidence of facility to facility transmission exists
- Cultured shrimp not really “domesticated”; analogy may be unsound (transmission by water)

Data ***Gaps***

- Exposure of wild shrimp to infected cultured shrimp & byproducts
- Susceptability and recovery of wild U.S. shrimp

Data Gaps

Virus Sources and Pathways - Aquaculture

- Water exchange with natural waters - protocols for aquaculture operations, water treatment, etc.
- Number, size (and location) of aquaculture operations in relationship to native shrimp populations
- Volume, disposal patterns, and treatment of solid wastes
- Extent of virus contamination of feed, broodstock/seed, vehicles, and birds/animals that could transport virus

- Epidemiology of virus transmission
- Host-specificity of viruses
- Exposure and wild shrimp to infected cultured shrimp and byproducts
- Susceptability and recovery of wild U.S. shrimp
- Technologies to monitor infection and transmission

SUMMARY PRESENTATION OF REVIEWERS' PREMEETING COMMENTS

SHRIMP PROCESSING VIRUS PATHWAY AND SOURCES

Prepared by:

Dr. Jack Gentile
University of Miami

Shrimp Virus Workshop

Shrimp Processing Pathway

John H. Gentile, Facilitator - U. Miami
Ned Alcanthie - NOAA/NMFS
Dwaine Braasch - U Southern Mississippi
Dana Dunkelberger - Palmetto Aquaculture Corp.
Jeffrey Lotz - U. Southern Mississippi
Roy Martin - National Fisheries Institute

Crystal Gateway Mariott Hotel
January 7-8, 1998

Shrimp Processing Pathway

Background

- Sixty countries exporting pond-raised and wild shrimp to the U.S.
- Fifty percent of shrimp processed in U.S. is from Thailand, India, and other countries
- Viral diseases are major problems in these countries
- Foreign shrimp are harvested at early stages of disease
- Increases likelihood of viral contamination of imports
- Virus infected shrimp have been identified in retail stores
- This pathway may pose a significant threat to wild shrimp

Charge to Expert Panel

Shrimp Processing

Question 11a.

Some believe it likely that shrimp processing operations have processed processed virus-infected shrimp from foreign sources for several years.

- What evidence do we have to support this statement?
- What is the magnitude of the problem
- Which foreign sources are shipping infected products
- Do we have accurate, diagnostic screening methods

Charge to Expert Panel

Shrimp Processing

Question 11b.

How does information from wild shrimp populations support or refute the importance of shrimp processing as a potential source for the virus?

- Do we have baseline data on viruses in wild pollutions?
- Do we have the appropriate diagnostic and detection methods?
- What evidence exists to link processing and wild shrimp viruses?
- What do we know of the persistence of viruses in water and sediments

Charge to Expert Panel

Shrimp Processing

Question 12.

Should retailers who distribute(rather than process) shrimp products receive additional evaluation as potential sources of exposure?

- Is there evidence of viruses in retail products?
- What are the potential human health risks from this pathway
- What are the routes from the retail market to the environment?
- Do these routes represent potentially significant sources for the viruses to enter the environment?

Pre-meeting Comments on Shrimp Processing

Question 11a.

Some believe it likely that shrimp processing operations have processed processed virus-infected shrimp from foreign sources for several years.

Agree - 92%

Question 11b.

How does information from wild shrimp populations support or refute the importance of shrimp processing as a potential source for the virus?

Evidence neither supports or refutes - 93%

Question 12.

Should retailers who distribute(rather than process) shrimp products receive additional evaluation as potential sources of exposure?

Should receive additional evaluation - 84 %

Shrimp Processing Pathway

Information Needs

- Volume, disposal patterns, and treatment practices for both shrimp processing effluents and solids
- Number, size, and spatial distribution of shrimp processing plants relative to receiving water and habitats for wild shrimp
- Estimates of the extent of virus contamination of shrimp received from foreign sources for processing
- Extent and distribution of contaminated shrimp in retail seafood markets and effluent and solids disposal practices
- Extent of virus contamination of shrimp and fish feeds

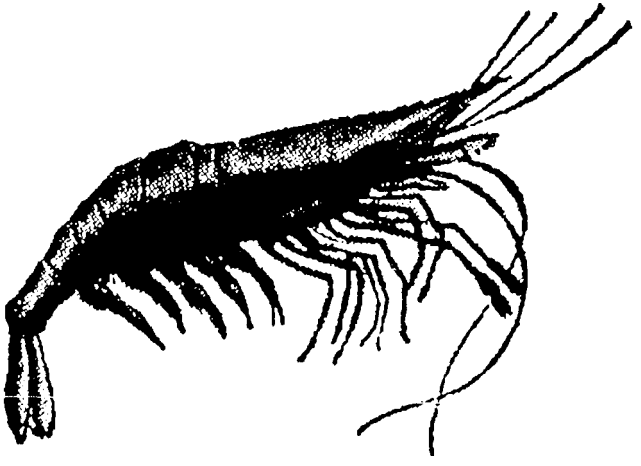
SUMMARY PRESENTATION OF REVIEWERS' PREMEETTNG COMMENTS

OTHER VIRUS PATHWAY AND SOURCES; VIRAL STRESSORS AND CROSS-CUTTING ISSUES; STRESSOR EFFECTS AND CROSS-CUTTING ISSUES

Prepared by:

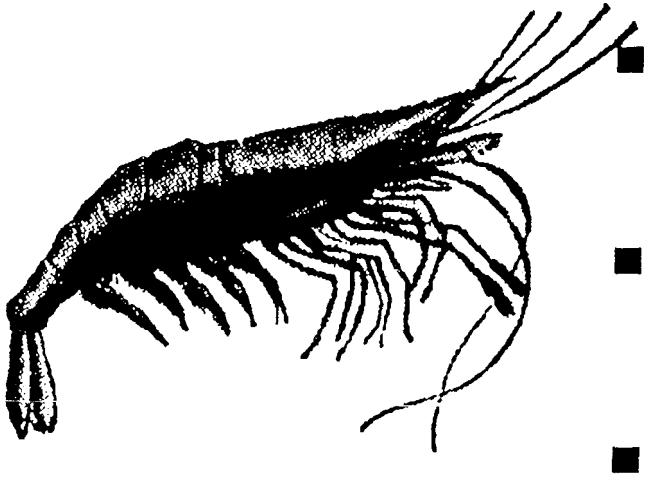
Dr. Anne Fairbrother
Ecological Planning and Toxicology, Inc.

Other potential virus sources



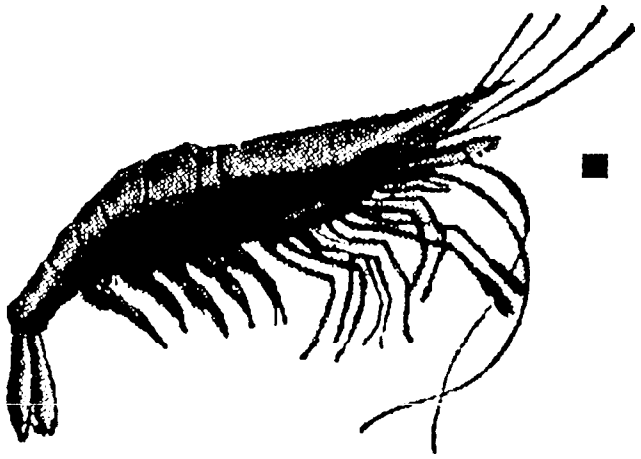
- bait shrimp
- ballast water
- other introduced crustaceans
- manufactured shrimp feed
  - high processing temperature (>80 ^{O}C/175 ^{O}F) would kill viruses
- research and display
- avian vectors
- fishing vessels
- natural spread

Virus factors



- relevance of laboratory information’
- development of immunity and reduction of impact on shrimp
- separating effects of multiple stressors
- human health effects from shrimp viruses
- shrimp virus ID techniques

Relevance of laboratory information



- infectivity information is valuable
- exposures may differ from natural situations
  - injection studies may not be relevant
- stress factors generally are lacking in laboratory studies
  - may make natural populations more or less susceptible
- mode of transmission, viability in the environment, carrier states

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Ecological Planning and Toxicology, Inc.

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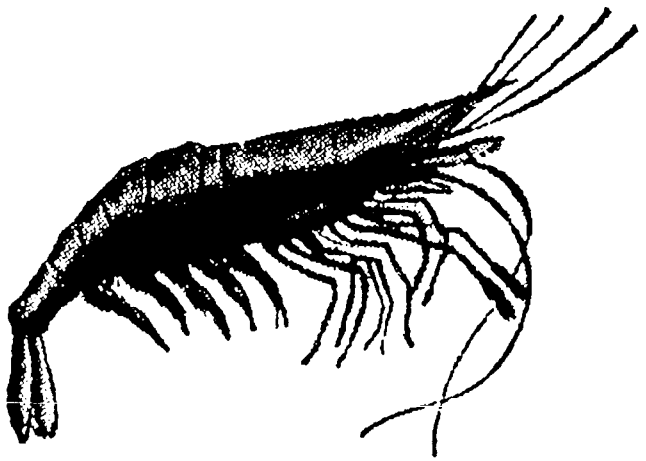

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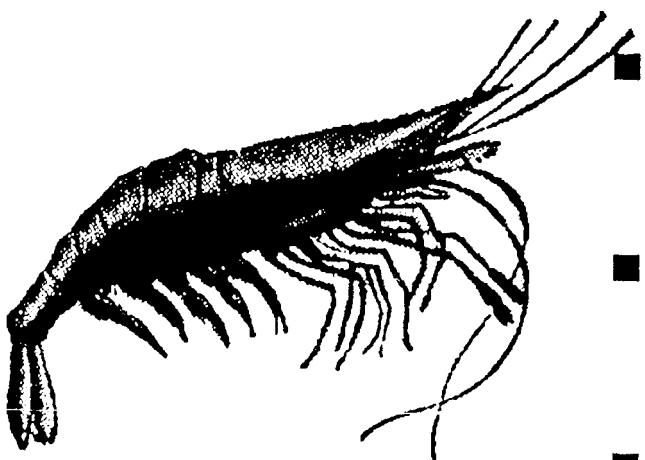

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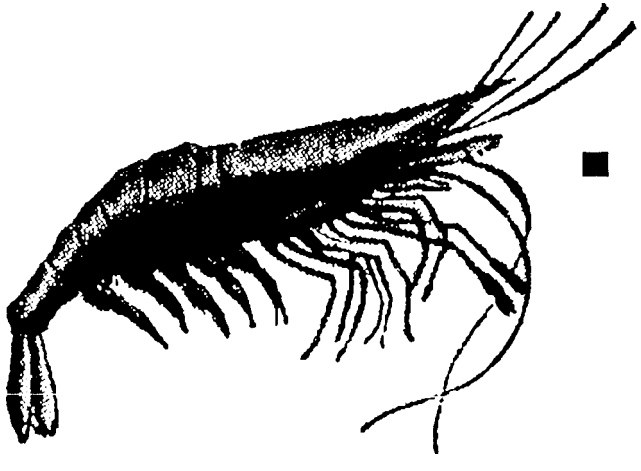
Relevance of laboratory information



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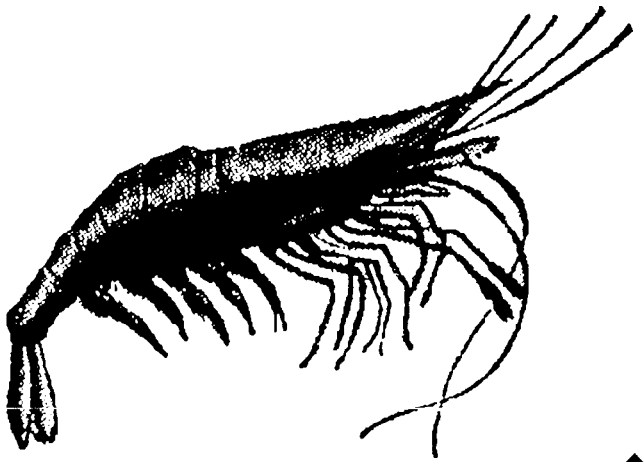
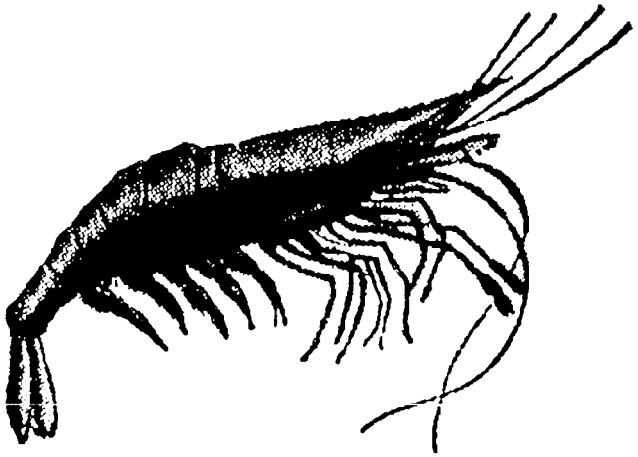
Shrimp immunity

- no immunological memory
- natural selection of disease-resistant individuals more likely
  - historical examples of host / pathogen co-adaptation exists
    - example: Central & South American attempts at inoculating shrimp populations resulted in increased host resistance
  - I may / may not be changes in viral virulence

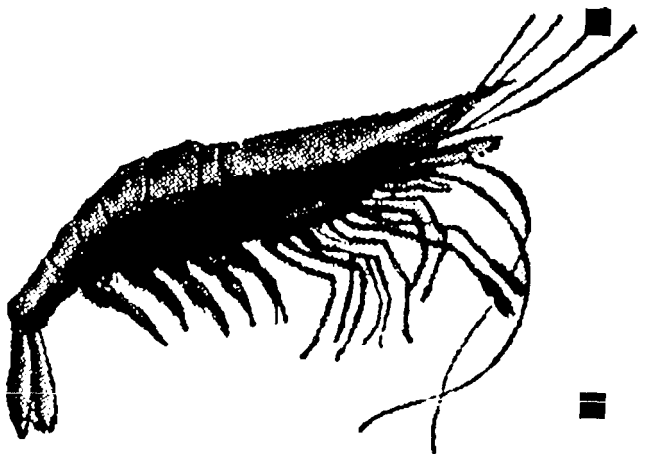


Multiple stressors
pathogens, pollution, salinity, temperature, biota



- it is not possible to separate effects of multiple stressors on shrimp populations
- first do lab studies / controlled experiments
- natural experiments of pops w/ & w/o virus (but all else equal.. .)
- look for correlations of shrimp pop changes w/ other environ change
- need comprehensive models

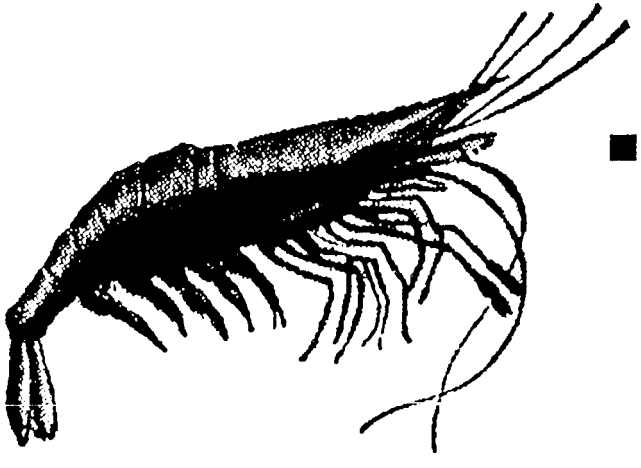
Human health effects



- unknown but presumed low probability
- baculovirues (e.g., WSBV) do not infect vertebrates
- other 3 groups have viruses that are pathogenic to vertebrates
  - only 1 (rhabdoviruses; YHV) have demonstrated zoonotic potential
- **Virus** that infect both vertebrate & inverts are in a different virus **group** (arboviruses)

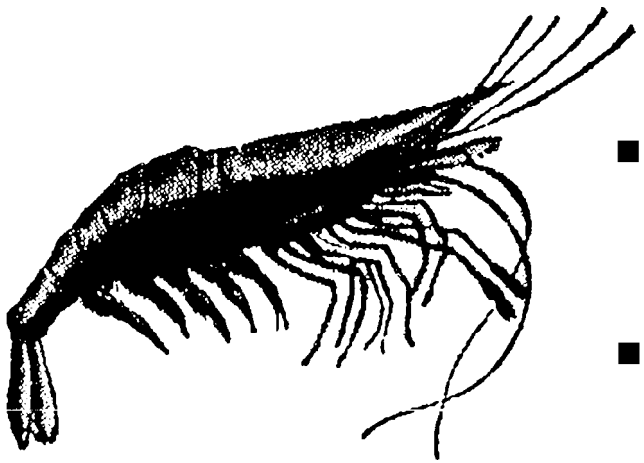
Shrimp virus identification

- some viruses have very reliable techniques (PCR, DNA probes, ELSIAs)



- others till rely on histopathology and electron microscopy

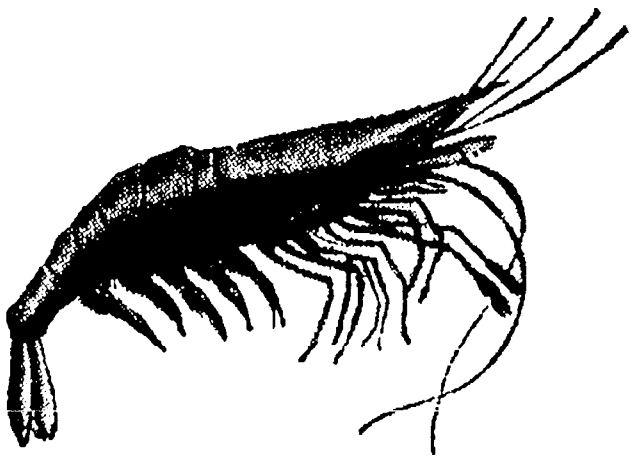
Stressor effects



- interpretation of evidence of prior virus introductions
- evaluation of lack of information on virus prevalence
- use of shrimp models to interpret effects of viruses
- importance of viral effects on non-shrimp species

Prior virus introductions [1]

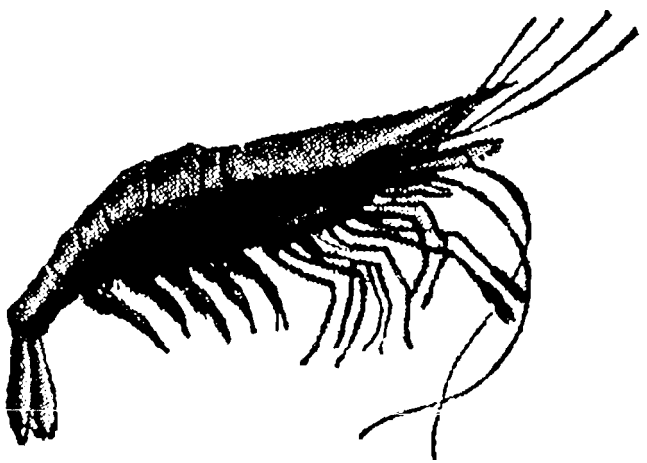
- Decline of shrimp in Gulf of California
  - IHHNV was not *proven* to be the cause (others: pollution and low DOS
  - 25% pop fluctuation not unusual
  - naturally high mortality rate suggests that impact of virus-induced mortality would be minimal



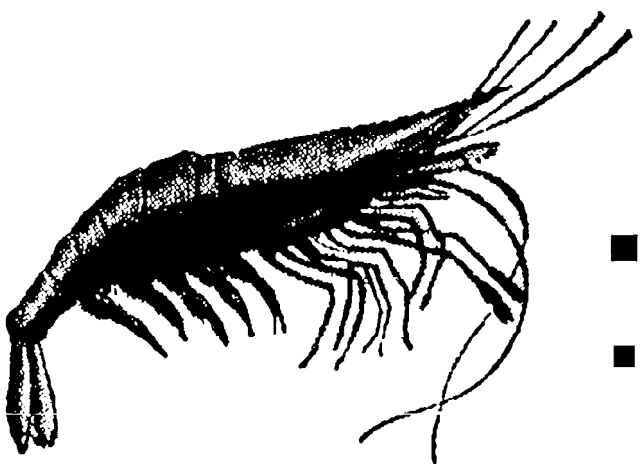
Prior virus introductions [2]

- TSV release from S. American aquaculture
  - unknown if TSV was endemic prior to aquaculture problems

  mother factors: loss of mangroves, antimicrobials, pathogenic bacteria, pollutants



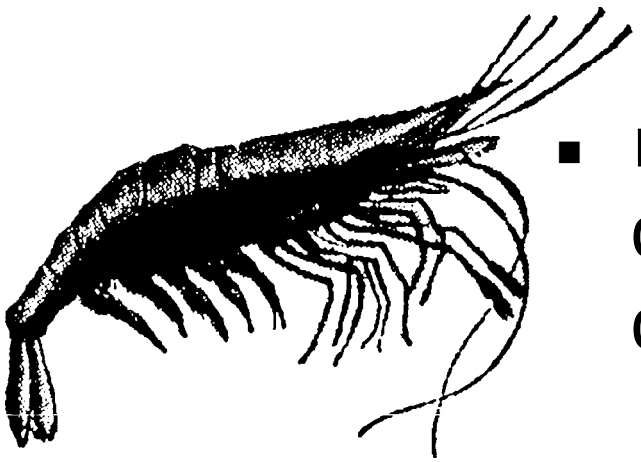
virus prevalence



- need this information for a proper risk assessment
- have some information on baculovirus prevalence, but not about effects
- need good diagnostic methods
- assume naive population for qualitative estimate of risk of introductions

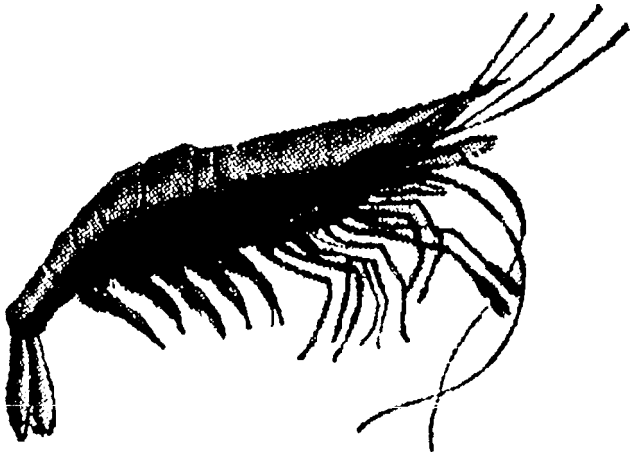
Shrimp models to predict effects [1]

- look for unexplained mass mortality or population declines -- then see if can detect virus pathogenically
  - need info on baseline prevalence



- need to know population controlling factors and what constitutes normal fluctuations
  - 25% change in pop size is normal
  - additional mortality from virus may not be detectable or important

Shrimp models to predict effects [2]



- epidemiological models can provide the parameters of what would be needed for an outbreak to occur
  - genetic structure
  - population demographic factors
  - other stressors and effects
  - virus factors
    - transmission rates, stage-specific mortality, environmental persistence

Importance of viral effects on non-shrimp species

- IHHNV, TSV, and [YHV] only infect penaeid shrimp. WSSV kills freshwater crayfish, prawns, and other crustaceans
- indirect effects
  - kill what shrimp eat
  - reduce prey base for shrimp predators
  - act as vectors or transport hosts
- look in Asia to see if non-shrimp species carry shrimp viruses